



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT
ATTORNEY DOCKET NO. 040894-5699

In re Application of:

Takashi NAKAMURA et al.

Application No.: 09/935,639

Filed: August 24, 2001

For: SEMICONDUCTOR DEVICE AND
METHOD FOR MANUFACTURING
THE SAME

Confirmation No.: 1378

Group Art Unit: 2814

Examiner: S. Rao

Commissioner for Patents
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Sir:

RESPONSE AND REQUEST FOR RECONSIDERATION

In response to the Office Action dated June 4, 2003 (Paper No. 12), the period for response to which extends through October 6, 2003 (October 4, 2003 being a Saturday) by the concurrent filing of a request for one-month extension of time and corresponding fee payment, favorable reconsideration and allowance of the subject application are respectfully requested in view of the following remarks.

Summary of the Office Action

Claims 1, 3, 7, 8, 15, 16 and 31 stand rejected under 35 U.S.C. §102(b) as being anticipated by FIGs. 17 and 18 of the present application (referred to by the Office Action as AAPR).

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Claims 2, 4-6, and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *FIGs. 17 and 18 of the present application* in view of *Hayashi et al.* (U.S. Patent No. 6,133,092).

Claims 9-12, 14 and 32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *FIGs. 17 and 18 of the present application* in view of *Hayashi et al.*, and further in view of *Xing* (U.S. Patent No. 6,492,222).

Summary of the Response to the Office Action

No changes to the claims have been proposed by this response. Accordingly, claims 1-30, 32 and 33 are currently pending, with claims 1-16, 32 and 33 currently under consideration.

The Office Action Summary, PTO FORM 326 accompanied the Office Action, indicates that claims 1-33 are pending in the present application. However, in the Amendment filed on March 19, 2003, Applicants cancelled claim 31 without prejudice or disclaimer. Thus, Applicants respectfully request the next official communication to acknowledge the cancellation of claim 31.

Interview with the Examiner

As an initial matter, Applicants would like to thank the Examiner for hosting an in-person interview with Applicants' undersigned representative on September 24, 2003. The Interview Summary provided to Applicants' undersigned representative contains a typographical error in that the date of interview is given as September 23, 2003. Applicants assume that the Interview Summary intended to indicate the data of interview as September 24, 2003. If Applicants' understanding and assumption are inaccurate, further clarification is respectfully requested with the next office communication.

Claim Rejections Under 35 U.S.C. §102(b)

Claims 1, 3, 7, 8, 15, 16 and 31 stand rejected under 35 U.S.C. §102(b) as being anticipated by *FIGs. 17 and 18 of the present application* (referred to by the Office Action as AAPR). The rejection is respectfully traversed for at least the following reasons.

With regard to claim 31, Applicants respectfully request withdrawal of the rejection of claim 31 at least because the March 19, 2003 Amendment cancelled claim 31 without prejudice or disclaimer, and the cancellation of claim 31 renders the rejection moot.

With regard to claims 1, 3, 7, 8, 15 and 16, Applicants respectfully submit that even assuming that *FIGs. 17 and 18 of the present application* were prior art against the present invention, *FIGs. 17 and 18 of the present application* still fail to teach or suggest the claimed combinations as set forth in independent claims 1 and 8 including at least a barrier layer “consisting of amorphous or microcrystal expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), where M1 is selected from a group consisting of Au, Pt, Ir, Pd, Os, Re, Rh, Ru, Cu, Co, Fe, Ni, V, and Cr, and M2 is selected from a group consisting of Ta, Ti, Zr, Hf, W, Y, Mo, and Nb.” In addition, Applicants respectfully submit that neither FIG. 17 nor FIG. 18 of the present application teaches or suggests the claimed combination as set forth in independent claim 15 including at least “amorphous or microcrystal single layer expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), where M1 is selected from a group consisting of Au, Pt, Ir, Pd, Os, Re, Rh, Ru, Cu, Co, Fe, Ni, V, and Cr, and M2 is selected from a group consisting of Ta, Ti, Zr, Hf, W, Y, Mo, and Nb.”

In the rejection, the Office Action asserts that the lower electrode (5) and the upper electrode (7) correspond to the layer expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), as set forth in independent claims 1, 8 and 15. See page 2, lines 23-25 of the Office Action. However,

as mentioned at page 1, lines 19-21 of the specification, the arrangement shown in FIG. 17 includes “a lower electrode 5 consisting of platinum...and an upper electrode 7 consisting of platinum (emphasis added).” Thus, both the lower and upper electrodes (5, 7) of the arrangement shown in FIG. 17 do not teach or suggest an element other than platinum (Pt).

In addition, during the September 24, 2003 interview, the Examiner expressed that he relies upon the lower electrode (5) made of platinum as allegedly satisfying M1 of Applicants’ claimed combinations, and relies upon Zr or Ti component of the ferroelectric layer (6) made of PZT film as allegedly satisfying M2 of Applicants’ claimed combinations. However, even assuming that the lower electrode (5) and the ferroelectric layer (6) shown in FIG. 17 of the present invention were one layer (which Applicants strongly disagree), the Pt component of the lower electrode (5) and the Zr or Ti component of the ferroelectric layer (6) still fail to teach or suggest the relationship expressed by “ $M1_xM2_{1-x}$ ($0 < x < 1$),” as set forth in Applicants’ claimed combinations.

Accordingly, Applicants respectfully submit that neither FIG. 17 nor FIG. 18 of the present application teaches or suggests the claimed combinations as set forth in independent claims 1 and 8 including at least a barrier layer “consisting of amorphous or microcrystal expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), where M1 is selected from a group consisting of Au, Pt, Ir, Pd, Os, Re, Rh, Ru, Cu, Co, Fe, Ni, V, and Cr, and M2 is selected from a group consisting of Ta, Ti, Zr, Hf, W, Y, Mo, and Nb.” In addition, Applicants respectfully submit that neither FIG. 17 nor FIG. 18 of the present application teaches or suggests the claimed combination as set forth in independent claim 15 including at least “amorphous or microcrystal single layer expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), where M1 is selected from a

group consisting of Au, Pt, Ir, Pd, Os, Re, Rh, Ru, Cu, Co, Fe, Ni, V, and Cr, and M2 is selected from a group consisting of Ta, Ti, Zr, Hf, W, Y, Mo, and Nb.”

M.P.E.P. §2131 states “[t]o anticipate a claim, the reference must teach every element of the claim.” Applicants respectfully submit that since *FIGs. 17 and 18 of the present application* do not teach or suggest all of the features of independent claims 1, 8, and 15, *FIGs. 17 and 18 of the present application* do not anticipate claims 1, 8, and 15. Further, since claims 3, 7, and 16 depend from claim 1, it is respectfully submitted that *FIGs. 17 and 18 of the present application* also do not anticipate claims 3, 7, and 16.

It is further respectfully submitted that dependent claims 3, 7 and 16 are not anticipated by *FIGs. 17 and 18 of the present application* for additional reasons. For instance, claim 7 depends on claim 6, which is rejected by the Office Action by relying on *FIGs. 17 and 18 of the present application* and *Hayashi et al.* Thus, the citation of an additional reference inherently admits that *FIGs. 17 and 18 of the present application* fail to teach every feature of claim 6, thereby admitting that *FIGs. 17 and 18 of the present application* would not anticipate claim 6 or claim 7, which depends from claim 6.

Accordingly, withdrawal of the rejection of claims 1, 3, 7, 8, 15 and 16 under 35 U.S.C. §102(b) is respectfully requested.

Claim Rejections Under 35 U.S.C. §103(a)

Claims 2, 4-6, and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *FIGs. 17 and 18 of the present application* in view of *Hayashi et al.* Claims 9-12, 14 and 32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *FIGs. 17 and 18 of the present application* in view of *Hayashi et al.*, and further in view of *Xing*. These rejections are respectfully traversed for at least the following reasons.

Claims 2 and 4-6

With regard to claims 2 and 4-6, Applicants respectfully submit that *Hayashi et al.* fails to remedy the deficiencies of *FIGs. 17 and 18 of the present application* as discussed above. Further, it is respectfully submitted that *Hayashi et al.* is not relied upon to teach the layer expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), as set forth in independent claim 1. Accordingly, Applicants respectfully submit that *FIGs. 17 and 18 of the present application* and *Hayashi et al.*, whether taken alone or in combination, fail to render independent claim 1 unpatentable. Further, Applicants respectfully submit that *FIGs. 17 and 18 of the present application* in view of *Hayashi et al.* also do not render claims 2 and 4-6 unpatentable at least because their dependence upon claim 1.

Claims 9-12

Applicants respectfully submit that both *Hayashi et al.* and *Xing* fail to remedy the deficiencies of *FIGs. 17 and 18 of the present application* as discussed above. Further, it is respectfully submitted that *Hayashi et al.* is not relied upon to teach the layer expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), as set forth in independent claim 8.

In addition, with respect to claims 9, 11 and 12, the Office Action cites column 9, line 10 of *Xing* as allegedly teaching an IrTa layer. See, for example, page 7, lines 12-14 of the Office Action. However, column 9, lines 7-11 of *Xing* describes:

Preferably, the bottom electrode...is comprised of a noble metal or conductive oxide such as iridium, iridium oxide, Pt, Pd, PdO_x, Au, Ru, RuO_x, Rh, RhO_x, LaSrCoO₃, (Ba,Sr)RuO₃, LaNiO₃ or any stack of combination thereof.

Thus, Applicants respectfully submit that *Xing* does not discuss Tantalum (Ta) or Ir_xTa_{1-x}, as asserted by the Office Action.

During the September 24, 2003 interview, the Examiner expressed that he interprets Ta

as one of the noble metals, as mentioned at column 9, line 8 of *Xing*. However, Applicants respectfully submit that Tantalum (Ta) is not a noble metal, at least because *Xing*, at column 10, lines 18-19, discloses “noble metal electrodes such as Pt, Pd, Au, Ag, Ir, Rh, and Ru,” without mentioning Tantalum (Ta). Accordingly, Applicants respectfully traverse the Office Action’s assertions that Ta is one of the noble metals and that *Xing* teaches an $\text{Ir}_x\text{Ta}_{1-x}$ layer. If the next office communication maintains the same assertions, Applicants respectfully request that evidence be provided in accordance with M.P.E.P. §2144.03.

Accordingly, Applicants respectfully submit that *FIGs. 17 and 18 of the present application, Hayashi et al.*, and *Xing*, whether taken alone or in combination, fail to render independent claim 8 unpatentable. Further, Applicants respectfully submit that *FIGs. 17 and 18 of the present application* in view of *Hayashi et al.* and *Xing* also do not render claims 9-12 unpatentable at least because their dependence upon claim 8.

Claim 13

Applicants respectfully submit that *FIGs. 17 and 18 of the present application* and *Hayashi et al.*, whether taken alone or in combination, fail to teach or suggest the claimed combination as set forth in independent claim 13 including at least “a barrier layer formed between said dielectric layer and said upper electrode, consisting of amorphous or microcrystal expressed by an expression of $\text{M1}_x\text{M2}_{1-x}$ ($0 < x < 1$), where M1 is selected from a group consisting of Au, Pt, Ir, Pd, Os, Re, Rh, Ru, Cu, Co, Fe, Ni, V, and Cr, and M2 is selected from a group consisting of Ta, Ti, Zr, Hf, W, Y, Mo, and Nb.”

For the reasons discussed above, *FIGs. 17 and 18 of the present application* also do not disclose the layer expressed by an expression of $\text{M1}_x\text{M2}_{1-x}$ ($0 < x < 1$), as set forth in independent

claim 13. Similarly, it is respectfully submitted that *Hayashi et al.* is not relied upon to teach the layer expressed by an expression of $M1_xM2_{1-x}$ ($0 < x < 1$), as set forth in independent claim 13.

Claim 14

The Office Action cites column 9, line 10 of *Xing* as allegedly teaching an IrTa layer.

See page 8, lines 7-8 of the Office Action. However, column 9, lines 7-11 of *Xing* describes:

Preferably, the bottom electrode...is comprised of a noble metal or conductive oxide such as iridium, iridium oxide, Pt, Pd, PdO_x, Au, Ru, RuO_x, Rh, RhO_x, LaSrCoO₃, (Ba,Sr)RuO₃, LaNiO₃ or any stack of combination thereof.

Thus, Applicants respectfully submit that *Xing* does not discuss Tantalum (Ta) or Ir_xTa_{1-x}, as asserted by the Office Action.

During the September 24, 2003 interview, the Examiner expressed that he interprets Ta as one of the noble metals, as mentioned at column 9, line 8 of *Xing*. However, Applicants respectfully submit that Tantalum (Ta) is not a noble metal, at least because *Xing*, at column 10, lines 18-19, discloses “noble metal electrodes such as Pt, Pd, Au, Ag, Ir, Rh, and Ru,” without mentioning Tantalum (Ta). Accordingly, Applicants respectfully traverse the Office Action’s assertions that Ta is one of the noble metals and that *Xing* teaches an Ir_xTa_{1-x} layer. If the next office communication maintains the same assertions, Applicants respectfully request that evidence be provided in accordance with M.P.E.P. §2144.03.

Accordingly, Applicants respectfully submit that *FIGs. 17 and 18 of the present application, Hayashi et al.*, and *Xing*, whether taken alone or in combination, fail to render claim 14 unpatentable.

Claim 32

Applicants respectfully submit that *FIGs. 17 and 18 of the present application, Hayashi et al.*, and *Xing*, whether taken alone or in combination, fail to teach or suggest the claimed

combination as set forth in independent claim 32 including at least “an amorphous or microcrystal barrier layer made of IrTaPt.”

In the rejection, the Office Action cites column 9, line 10 of *Xing* as teaching an IrTaPt layer. See page 8, lines 9-10 of the Office Action. However, column 9, lines 7-11 of *Xing* describes:

Preferably, the bottom electrode...is comprised of a noble metal or conductive oxide such as iridium, iridium oxide, Pt, Pd, PdO_x, Au, Ru, RuO_x, Rh, RhO_x, LaSrCoO₃, (Ba,Sr)RuO₃, LaNiO₃ or any stack of combination thereof.

Thus, Applicants respectfully submit that *Xing* does not discuss Tantalum (Ta) or IrTaPt, as asserted by the Office Action.

During the September 24, 2003 interview, the Examiner expressed that he interprets Ta as one of the noble metals, as mentioned at column 9, line 8 of *Xing*. However, Applicants respectfully submit that Tantalum (Ta) is not a noble metal, at least because *Xing*, at column 10, lines 18-19, discloses “noble metal electrodes such as Pt, Pd, Au, Ag, Ir, Rh, and Ru,” without mentioning Tantalum (Ta). Accordingly, Applicants respectfully traverse the Office Action’s assertions that Ta is one of the noble metals and that *Xing* teaches an IrTaPt layer. If the next office communication maintains the same assertions, Applicants respectfully request that evidence be provided in accordance with M.P.E.P. §2144.03.

It is respectfully submitted that none of *FIGs. 17 and 18 of the present application*, *Hayashi et al.*, and *Xing*, discloses a barrier layer made of IrTaPt, as set forth in independent claim 32. Accordingly, Applicants respectfully submit that *FIGs. 17 and 18 of the present application*, *Hayashi et al.*, and *Xing* whether taken alone or in combination, fail to render independent claim 32 unpatentable.

In view of the above, withdrawal of the rejections of claims 2, 4-6, 9-14 and 32 under 35 U.S.C. §103(a) is respectfully requested.

Conclusion

In view of the foregoing, withdrawal of the rejections and allowance of the pending claims are earnestly solicited. Should there remain any questions or comments regarding this response or the application in general, the Examiner is urged to contact the undersigned at the number listed below.

If there are any other fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-0310. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such extension is requested and the fee should also be charged to our Deposit Account.

Respectfully submitted,

MORGAN, LEWIS & BOCKIUS LLP

Dated: October 6, 2003

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